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PILATUS PC-12 NGX

AN UP-CLOSE LOOK AT THE TECH BEHIND THE TURBOPROP

by **Rich Pickett**

As a follow up to our initial review of Pilatus' PC-12 NGX in our December 2019 issue of Twin & Turbine, Tom Aniello, vice president of marketing, offered us the opportunity to fly the plane at the Pilatus Business Aircraft (a Pilatus Aircraft subsidiary) facility located at Rocky Mountain Regional Airport (KBJC).

Over the years, I have flown the previous PC-12 models for personal, business, charter and disaster relief flights, so I've experienced Pilatus' updates firsthand. Now, with nearly 1,800 PC-12s produced, they have introduced the most extensive upgrade of the PC-12 to date – the NGX. It is the first with Pratt and Whitney Canada's latest PT6, the PT6E-67XP. Developing 1,200 SHP, it is the first production turboprop engine with a dual-channel EPEC (Electronic Propeller and Engine Control), controlling both engine and propeller.

Preflight

When conducting a preflight of the NGX, starting with the engine and its environs, you notice several changes. From the simple, such as re-routing the oil level sensor wiring, to the absence of the traditional propeller governor, to the EPECS and DCTU (Data Collection Transfer Unit) in compartments beneath the engine. The Manual Override lever (MOR) and condition lever are not required since these functions are now managed by the EPECS. The pilot has a single power control lever (PCL).

Externally you can't see the upgraded fuel system of the NGX, but a more effective oil/fuel heat exchanger is incorporated with motive flow jet fuel pumps, improved vents and lines insulated. These changes also eliminate the requirement for anti-icing additives. An important consideration since these additives are not widely available in many parts of the world.

The Brains

EPECS is a complex system of control and sensor components for the engine and propeller – from the engine oil level sensor to the Throttle Quadrant (and PCL) to the Permanent Magnet Alternator (PMA). The electronic engine control (EEC) component of the EPECS monitors over 100 parameters, and in conjunction with the Propeller Control Unit (PCU) and the Fuel Control Unit (FCU), manages the engine and propeller based upon power requirements set by the pilot or autothrottle. Yes – the NGX has a very effective autothrottle!

The start process is automatic, with fuel and ignition now controlled by the EEC, virtually identical to FADECs in many turbine engines. In the event of a hot or hung start, the EEC will not only shut down the engine, it will automatically activate a dry motoring sequence. If the ITT is initially high during a start, such as during a quick turn, the EEC will not activate ignition or add fuel until it is less than 150 degrees Celsius. While pilots always need to monitor for potential issues during the start, this configuration reduces the chances of that occurring.

The DCTU collects the EEC data and transmits via cellular or Wi-Fi to a repository after landing, or it can be downloaded manually. It is also a key component if the operator subscribes to PWC's pay-per-hour platinum ESP maintenance program.

With this combination of components, the engine can be optimized for all phases of operation and service life. This is one reason the TBO intervals are now 43 percent longer at 5,000 hours, HSI only on condition, and other engine maintenance intervals are doubled. This is in addition to a 10 percent increase in power when compared to the PT6-67P engine, equating to faster climbs and higher cruise speeds.

Pilatus has also developed an innovative approach to reduce cabin and overflight noise. When takeoff conditions permit, using the Low Speed Mode button, the pilot can select 1,550 RPM versus 1,700 RPM for the Hartzell 5-composite-blade 105-inch diameter propeller. In fact, you can use the Low Speed Mode in all phases of flight except in known icing or steep approaches. There is probably no technical reason for this restriction, it is in place simply because the Low Speed Mode hasn't been certified under these conditions – yet. The de-icing system for the propeller is intelligent, selecting the appropriate blade heating profile based upon the OAT; nothing could be simpler.

The Cabin

Pilatus took the already-large cabin windows of the PC-12 and made them 10 percent larger. To the passengers, it provides a substantial change in their outside view.

As Pilatus likes to say, the PC-12 series is "designed for those that refuse to travel light." The spacious cabin and cargo area fit that need. The new NGX interior features an improved seat design, allowing seats to fully recline when not against a bulkhead. Multiple cabin configurations are available, from their new air ambulance (which can accommodate two stretchers) to the executive and commuter designs. Even seat removal is easier with the NGX.

The PC-12 NGX also features a vastly improved air circulation and cooling system, providing 500 CFM of conditioned air through new ducting and a continuous vent along the entire overhead, similar in design to a commercial airliner. This significantly reduces the noise level in comparison with using the flood mode of earlier PC-12s. Couple these changes with redesigned side panels, ample AC and USB power outlets, and passengers will experience a noticeable improvement.

Flight Deck

The flight deck has undergone such a significant upgrade that Pilatus has coined the term "Advanced Cockpit Environment (ACE) powered by Honeywell." It is aptly named.

Overhead you notice a new way to start the engine: two switches – Engine Run/Off and Starter. The lower center console has been simplified with the removal of the MOR and condition levers as mentioned. Progressing from the power quadrant toward the instrument panel the pilots now have a touch panel to control avionics and system functions. In keeping with the ACE concept, other procedures are simplified, with the majority of the cockpit featuring a design that will be familiar with NG pilots.

With the NGX, Pilatus introduced the autothrottle as an option, one that is selected by almost all operators. The pilot selects FMS or Manual Mode to set the speed. FMS mode optimizes the speed for the flight phase, from airspace restricted speeds to selecting the appropriate speed for an IFR or VFR approach. To adjust speed to the desired value, APEX sends a trim signal to the EPECS, which simply moves the Power Control Lever (PCL) to the desired position.

The autothrottle is even active during Emergency Descent Mode (EDM), triggered by a cabin altitude warning above FL200. The plane turns 90 degrees left, descends at V_{mo} /M_{mo} to FL150, then levels at 160 KIAS. While the pilot can control speed without autothrottle, it does simplify the descent.

Flying the NGX

With Brian Mead, Pilatus demonstration pilot, we filed an IFR flight from KBJC to Salida, Colorado (KANK) about an hour away. We did a preflight in their hangar and then moved outside to their ramp on the southwest side of the airport. Our flight plan included the ROCKIES5.DBL departure then direct to Salida.

Setting up the aircraft configuration, including weights, is simple with an intuitive flow. We entered the flight plan into the FMS, which synchronized with the optional second FMS. I found the new touch panel controller improved efficiency. I could select functions on the touch panel while keeping my cursor focus on the MFD display, enabling me to multitask faster.

The checklists are embedded within ACE, easily selected and acknowledged using control yoke switches. Starting was simple. Move engine switch to ON, press the starter. The EEEC determines the optimum N2 speed at which to activate ignition and inject

Pilatus PC-12 NGX
By the Numbers

Max Speed*	286 KTAS/278 KTAS	FL220/FL300
Fuel Flow Max Speed*	483 PPH/380 PPH	FL220/FL300
Maximum Range (Long Range Cruise, FL300, 225KTAS, NBAA IFR Reserves)		
Maximum Payload (2,236 lbs)	694	nm
6 Passengers (1,200 lbs)	1,568	nm
4 Passengers (800 lbs)	1,803	nm
Max Ramp Wgt	10,495	lbs
MTOW (SL, ISA)	10,450	lbs
Basic Operating Wgt***	6,803	lbs
Useful Load	3,692	lbs
Usable Fuel Capacity	2,704	lbs
Max Fuel Payload**	988	lbs
Base Price	$4.390	M
Typically Equipped	$5.353	M

*Weight 9,000 lbs **Based on Max Ramp Wgt, Single Pilot - 200 lb
***Single Pilot (200 lb), As Flown

One Year Mark: PC-12 NGX Market Update

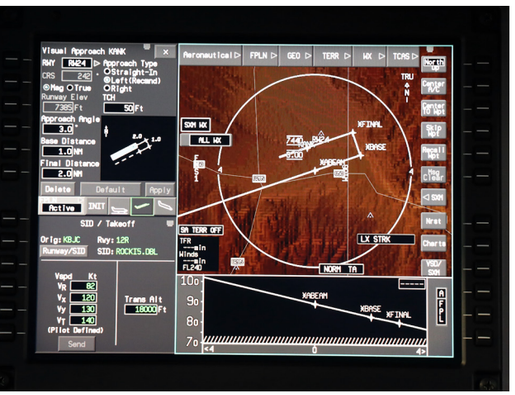
by Pilatus Aircraft

Since unveiling the fully certified PC-12 NGX to the public at the National Business Aviation Association's annual convention on October 21, 2019, the Swiss aircraft manufacturer has enjoyed strong interest and sales for the new model. As the third generation of the venerable PC-12 platform, the new NGX is easily the most significant upgrade since its original introduction in 1994. The new features detailed by Rich Pickett in this article have not gone unnoticed, as many owner-pilots are upgrading to the latest engine and avionics technology in the NGX, citing a dramatic reduction in pilot workload using the new autothrottle system. The all-new passenger seats, larger cabin windows and quiet air distribution system make the new model appealing to passengers.

The first delivery of the PC-12 NGX in the United States went to HP Inc. Director and former CEO, Dion Weisler. Weisler upgraded to the new model from his 2017 model year PC-12 NG, ordering his NGX as soon as Pilatus opened the order book last October. After the first flight in his new PC-12 NGX, Weisler stated, "I really loved my NG, but the NGX takes the PC-12 to an entirely new level. There's something for everyone: passengers enjoy the modern new cabin, and the autothrottle, single-power lever and electronic engine controls are a pilot's dream."

In Europe, the first PC-12 NGX delivery went to Dr. Ulrich Byszio in Germany. Dr. Byszio, a pilot with a passion for all forms of aviation, moved from a popular light jet to his new PC-12 NGX. "The PC-12 NGX is the perfect aircraft for my travels around Europe. The combination of its speed, fuel efficiency, comfort and safety record makes it ideal for both corporations and owner-pilots like myself. It offers an incredible level of versatility that can't be matched by anything else in this class," commented Dr. Byszio after taking delivery of his new NGX.

Following the first PC-12 NGX customer delivery in April of this year, Pilatus delivered 34 units of the new model by the end of October and is targeting a strong finish to 2020 in order to meet customer demand. Pilatus dealers around the world report a solid backlog of retail orders going into 2021 and are actively flying prospects in their demonstrator aircraft.



Top: Flying the RWY 24 visual approach at Salida with autothrottle and autopilot (photo by Tom Aniello).

Right: Simplified controls - new Power Control Lever and Touch Screen Controller (photo by author).

fuel. If the ITT is too high, it motors the engine a bit longer to lower the initial temperature. If the EEC detects a hot or hung start, it aborts the start and initiates a dry motor – without pilot intervention.

Equipped with SmartRunway and SmartLanding, the NGX provides improved situational awareness by alerting pilots if lined up on a runway different from what was programmed in the FMS for takeoff or landing. It also monitors other potential errors such as excessive approach angles.

Before departure I selected Go-Around (GA) and armed Autothrottle (AT) on the Flight Guidance Panel (FGP). Cleared for departure and advancing the Power Control Lever (PCL) the autothrottle takes control of the PCL just prior to Maximum Continuous Power (MCP) and moves it to takeoff. If Low Speed mode is desired for takeoff, the PCL is set to MCP and AT is not used. In this configuration takeoff roll increases approximately 300 feet.

With three of us in the plane and full fuel, an airport elevation of 5,600 MSL and OAT of 24 degrees Celsius, it was an effortless climb off of Runway 12R, then a climbing left turn with vectors to Red Table (RBL) VOR. Hand flying, with the AT set to FMS, the EPECS set power to meet the climb profile to our cruising altitude of FL200. The touch panel made easy work of tuning the radios, selecting weather and a host of other functions.

In cruise we experimented with the low and normal prop speed. Pilatus has reported a reduction of 2 to 3 decibels in the cabin while in low speed mode. I could tell we had a frequency change and lower noise level, however, my quick check in the cockpit didn't reveal much of a reduction with a decibel app using both A and Z weightings.

With EPECS, the EEC can fully control the engine for optimization. I noticed during the climb that it set climb power at a lower PSI torque (Pilatus uses PSI for torque measurement) of 34.5 versus 36.95 that I would set on an NG aircraft. This automation resulted in a slight decrease in climb rate but a cooler ITT of 750 degrees Celsius.

In addition to TCAS-II, we also had ADS-B In traffic in this plane. What makes this system unique is when you select the data tag of an aircraft, it will stay displayed so you can continually see the position changes. This TCAS-II Resolution Advisory also provides both climb/descent and turn commands to avoid conflicts.

Time to Land

Many avionics systems in turboprop and turbine aircraft can incorporate a visual approach to any runway with an advisory glide path. But none that I've flown can fly a visual pattern – which is possible with the PC-12 NGX!

It was incredibly easy to program, similar to defining a hold. I selected left pattern with a one-mile crosswind, downwind, base, and final for Runway 24 at Salida (KANK). The FMS determined the best waypoints, calculated the appropriate altitudes and speeds for the approach. The MFD also displays the vertical profile of our projected approach with terrain.

On downwind, I lowered the gear, selected 15 degrees flaps and the autothrottle reduced our speed to 110 KIAS. On base, I selected 30 degrees of flaps and we slowed to 100 KIAS, followed by 40 degrees and 90 KIAS on short final. It was eerie how smooth the automation was in the pattern.

Rich Pickett and Brian Mead, Pilatus demonstration pilot (photo by Tom Aniello).

Almost to the runway, Brian called out to me, "Autopilot off." I replied, "Why?" and smiled. With the autopilot disconnected and the radar altimeter calling out my altitude in increments of 10 feet, we landed. All we needed was automatic flaring and autoland would have been possible. Maybe that will be the next option.

Heading Home

After lunch at the Boat House on the banks of the Arkansas River, we took off on a VFR flight back to KBJC. I love hand flying the PC-12s, and the NGX is no exception. Passing Mount Evans on our right and descending over the Front Range, the usual afternoon turbulence was present, and it was an easy right downwind for Runway 12R. I taxied to the Pilatus hangar, set the engine switch to OFF and the EEC did the rest. If the OAT is above 23 degrees Celsius, it will dry motor on the shutdown to keep things cool.

Support

The Pilatus Business Aircraft Ltd facility is also home to their completion and support centers. Pilatus brings "green" PC-12 and PC-24 aircraft to Broomfield to paint, fabricate and install interiors, as well as customize each aircraft to the specifications of their new owners. In fact, 70 percent of the PC-12s worldwide are sold in North and South America, all completed at this facility. Their staff not only installs components, they actually build them, including seats, interior panels, cabinets with the same high quality I've seen at their Stans, Switzerland factory.

All new NGXs include a standard warranty comprised of 7 years/5,000 hours for the airframe, 2 years/2,000 hours for systems, a Honeywell 3-year warranty for the avionics, 5 years/2,500 hours by PWC on the engine, and a 6 years/4,000 hours propeller warranty. PWC is also offering its Platinum Engine Service Program (ESP) exclusively through Pilatus. This program provides virtually total service coverage, including FOD and corrosion, on an hourly basis at a current price of $145/flight hour.

Also based at KBJC is the headquarters for Pilatus' support program. Along with two regional centers in Stans, Switzerland and Adelaide, Australia, they provide 24/7/365 assistance to a global network of Pilatus Authorized Service centers and their satellite support facilities.

Summary

The first flight of the PC-12 NGX was in December 2017, a project that was kept under wraps for some time. Pilatus has come a long way since that first flight, developing an incredible aircraft alongside Pratt & Whitney Canada, Honeywell and other suppliers. From special operations, such as military and air ambulance to executive transport, the PC-12 NGX is a unique aircraft and illustrates Pilatus' continuous innovation. T&T

With 11,000+ hours of piloting more than 100 aircraft models **Rich Pickett** *still has a passion for flying. Rich holds an ATP, CFII SME, SES, glider licenses, and type ratings in the L29, L39, Citation 500/510s/525s, Eclipse 500S, Beechcraft Premier and DA10. His company, Personal Wings, provides training, mentoring and aircraft services. He is also a proud owner of an Eclipse and Cirrus SR22. You can contact Rich at* **rich@personalwings.com**.